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Analytical Methods

Coulometric titration with electrogenerated oxidants as a tool for evaluation of cognac and brandy antioxidant properties

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ABSTRACT

Stoichiometric coefficients for reactions of cognac antioxidants with coulometric titrants (electrogenerated bromine and hexacyanoferrate(III) ions) have been found. Ellagic and gallic acids react with both titrants while aldehydes (vanillin, syringic and coniferaldehyde) – with electrogenerated bromine only. Furfurals do not show significant reactivity toward both oxidants. Cognac and brandy total antioxidant capacity (TAC) and ferric reducing power (FRP) based on reactions with electrogenerated bromine and hexacyanoferrate(III) ions, respectively, have been evaluated. Both parameters for cognacs are statistically significant higher than for brandies and grow with the age increase. Beverages under investigation has shown relatively high antiradical activity toward 2,2-diphenyl-1-picrylhydrazyl (7–92% and 5–93% for cognacs and brandies, respectively). Total phenolics content has been evaluated by Folin–Ciocalteu method. Older beverages represent the higher phenolics content caused by more time of extraction from oak barrels. Positive correlations ($r = 0.8077–0.9617$) have been observed for TAC and FRP with antiradical activity and total phenolics content.

1. Introduction

Cognac is an alcoholic beverage rich in polyphenols and its moderate consumption has shown potential beneficial effects on health. Cognac has been described to possess antioxidant properties due to its phenolic constituents and has been established to decrease the risk of cardiovascular diseases (da Porto, Calligaris, Celotti, & Nicoli, 2000; Goldberg, Hoffman, Yang, & Soleas, 1999). Mechanisms that have been proposed to explain the prevention of cardiovascular diseases by polyphenols include reduced oxidation of low-density lipoprotein, inhibition of platelet aggregation and neutrophil adhesion (Carusio, Wangensteen, Filipelli, & Andriantsitohaina, 2008). Polyphenols have also been reported to affect the activity of enzymes critically involved in pathways regulating cell proliferation and activation (Perez-Vizcaino, Duarte, & Andriantsitohaina, 2006).

Despite the extensive works devoted to the assessment of the antioxidant properties of several wines and other alcoholic beverages in relation to their phenolic content (de Quirós, Lage-Yusty, & López-Hernández, 2009; Figueiredo-González, Cancho-Grande, and Simal-Gándara, 2013; García, Grande, & Gándara, 2004; Puértolas, Saldaña, Condón, Álvarez, & Raso, 2010; Pérez-Lamela, García-Falcón, Simal-Gándara, and Orriols-Fernández, 2007), only few data have been presented on the antioxidant properties of cognac (da Porto et al., 2000; Goldberg et al., 1999). This is why, there is a constant quest to determine cognac antioxidant properties and associated methods of evaluation.

The most common approaches used for evaluation of antioxidant properties of alcoholic beverages are spectrophotometric determination of antiradical activity by reaction with 2,2-diphenyl-1-picrylhydrazyl (DPPH) (Aoshima, Tsunoue, Koda, & Kiso, 2004; da Porto et al., 2000) and total phenolics content by Folin–Ciocalteu method (Alonso, Castro, Rodriguez, Guillen, & Barroso, 2004; Vicente, de Abreu, Goulart, & de Vasconcelos, 2011).

Antioxidants being easily oxidizable compounds are widely investigated using electrochemical methods. A lot of articles have been focused on electrochemical evaluation of foodstuff antioxidant properties including alcoholic beverages, namely wines (Arribas et al., 2013; Šeruga, Novak, & Jakobek, 2011). Polarographic assay based on hydrogen peroxide scavenging has been developed for the determination of antioxidant activity of strong alcoholic beverages (Gorjanovic et al., 2010).

Special attention is paid to cognac and brandy recognition and classification based on their responses to the voltammetric electronic tongue analysis (Cetó, Llobet, Marco, & del Valle, 2013), mid infrared spectroscopy (Picque et al., 2006), front face fluorescence spectroscopy (Sádecká, Tóthová, & Májek, 2009) and further chemometric signals processing.

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